

WHAT IS CLAIMED IS:

1. A method for Optimizing Pre-saturation in a scan volume of an MRI system, comprising:
 - a. creating a B_0 map for each slice of the scan volume;
 - b. obtaining a first frequency for RF pre-pulses;
 - c. calculating a median value for the B_0 magnetic field from the B_0 map for each scan slice;
 - d. calculating the percentage of positive and negative scan slice pixels in each scan slice
2. A method for generating an image of a scan volume using an MRI system, the method comprising the steps of:
 - a. generating a B_0 map of each scan slice of the scan volume by measuring B_0 magnetic field distribution over each scan slice of the scan volume;
 - b. obtaining a first frequency of RF pre-pulses;
 - c. calculating a median value of the B_0 magnetic field over each scan slice, the calculation being done using the B_0 field maps;
 - d. calculating the percentage of positive and negative scan slice pixels in each scan slice, the calculation being done using the $B_{\text{sub}0}$ field map for each scan slice, wherein a positive scan slice pixel is defined as a scan slice pixel with positive value in the $B_{\text{sub}0}$ field map, and wherein a negative scan slice pixel is defined as a scan slice pixel with negative value in the $B_{\text{sub}0}$ field map;

- e. if the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of:
 - i. calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, the correction for a scan slice being done by using the median value of the B.sub.0 magnetic field over the scan slice calculated at step c;
 - else performing the steps of:
 - ii. improving the shimming; and
 - iii. repeating steps a through e; and
 - f. obtaining an MRI image of each scan slice, wherein the MRI image of a scan slice is obtained using RF pre-pulses at the second frequency for the scan slice.
3. The method of claim 1 wherein the step of calculating a second frequency of RF pre-pulses for a scan slice is done by adding the median value of the B.sub.0 magnetic field over the scan slice to the first frequency of RF pre-pulses.
 4. The method of claim 1 wherein the RF pre-pulses are used to suppress magnetic resonance signals from hydrogen nuclei in fat molecules present in the scan volume.
 5. The method of claim 1 wherein the RF pre-pulses are used to suppress magnetic resonance signals from hydrogen nuclei in macromolecules present in the scan volume.

6. The method of claim 1 wherein the RF pre-pulses are used to suppress magnetic resonance signals from hydrogen nuclei in water molecules present in the scan volume.
7. The method of claim 1 wherein the step of obtaining an MRI image of a scan slice comprises the steps of:
 - a. applying
 - i. RE pre-pulses at second frequency for the scan slice; and
 - ii. RE pulses at transmit frequency to the scan slice;
 - b. measuring magnetic resonance signals from the scan slice; and
 - c. processing the magnetic resonance signals to obtain an MRI image of the scan slice.
8. A method for generating an image of a scan volume using an MRI system, the method comprising the steps of:
 - a. generating a B._{sub.0} map of each scan slice of the scan volume by measuring B._{sub.0} magnetic field distribution over each scan slice of the scan volume and storing the B._{sub.0} map in a database;
 - b. obtaining a first frequency of RF pre-pulses;
 - c. calculating median value of the B._{sub.0} magnetic field over each scan slice, the calculation being done using the B._{sub.0} field maps stored in the database;
 - d. calculating the percentage of positive and negative scan slice pixels in each scan slice, the calculation being done using the B._{sub.0} field map for each scan slice, wherein a positive scan

slice pixel is defined as a scan slice pixel with positive value in the B.sub.0 field map, and wherein a negative scan slice pixel is defined as a scan slice pixel with negative value in the B.sub.0 field map;

- e. if the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of:

- i. calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, the correction for a scan slice being done by adding the median value of the B.sub.0 magnetic field over the scan slice calculated at step c to the first frequency of RF pre-pulses calculated at step b;

else performing the steps of:

- ii. improving the shimming; and
 - iii. repeating steps a through e;

- f. obtaining an MRI image of each scan slice using RF pre-pulses at second frequency for that scan slice;
- g. storing the MRI image of each scan slice obtained at step f in the database; and
- h. displaying the MRI images stored in the database on a display device.

- 9. The method of claim 7 wherein the RF pre-pulses are used to suppress magnetic resonance signals from hydrogen nuclei in fat molecules present in the scan volume.

10. The method of claim 7 wherein the step of obtaining an MRI image of a scan slice comprises the steps of:
 - a. applying
 - i. RF pre-pulses at second frequency for the scan slice; and
 - ii. RE pulses at transmit frequency to the scan slice;
 - b. measuring magnetic resonance signals from the scan slice; and
 - c. processing the magnetic resonance signals to obtain an MRI image of the scan slice.
11. An MRI system comprising:
 - a. a polarizing magnet for producing a high intensity magnetic field called B_{sub.0} magnetic field;
 - b. a set of shimming coils for improving B_{sub.0} magnetic field homogeneity;
 - c. a magnetic field detector for measuring B_{sub.0} magnetic field distribution;
 - d. a set of gradient coils for producing a gradient magnetic field superposed on the B_{sub.0} magnetic field;
 - e. a transmitter for generating RF pulses and RF pre-pulses wherein frequency of RF pre-pulses is specific for each scan slice;
 - f. a radio frequency receiver for detecting magnetic resonance signals;
 - g. a processing module comprising:

- i. a module for calculating the median of the B.sub.0 magnetic field over each scan slice;
 - ii. a module for calculating the percentage of positive and negative scan slice pixels in each scan slice, wherein positive scan slice pixels are defined as scan slice pixels with positive B.sub.0 magnetic field values, and wherein negative scan slice pixels are defined as scan slice pixels with negative B.sub.0 magnetic field values;
 - iii. a module for calculating a second frequency of RF pre-pulses for each scan slice by adding the median value of the B.sub.0 magnetic field over the scan slice to a first frequency of RF pre-pulses, the first frequency of RF pre-pulses being obtained by a standard procedure; and
 - iv. a module for processing magnetic resonance signals from a scan slice to obtain an MRI image of the scan slice-pulses for each scan slice; and
- h. a database comprising:
- i. a storage unit for storing B.sub.0 field maps;
 - ii. a second storage unit for storing the median value of the B.sub.0 magnetic field over each scan slice; and
 - iii. a third storage unit for storing an MRI image of each scan slice.
12. A computer program product for use with a computer, the computer program product comprising a computer usable medium having a computer readable program code embodied therein for generating an image using an MRI system, the computer program code performing the steps of:

- a. generating a B.sub.0 map of each scan slice of the scan volume by measuring B.sub.0 magnetic field distribution over each scan slice of the scan volume;
 - b. obtaining a first frequency of RF pre-pulses;
 - c. calculating median value of the B.sub.0 magnetic field over each scan slice, the calculation being done using the B.sub.0 field maps;
 - d. calculating the percentage of positive and negative scan slice pixels in each scan slice, the calculation being done using the B.sub.0 field map for each scan slice, wherein a positive scan slice pixel is defined as a scan slice pixel with positive value in the B.sub.0 field map, and wherein a negative scan slice pixel is defined as a scan slice pixel with negative value in the B.sub.0 field map;
 - e. if the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of:
 - i. calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, the correction for a scan slice being done by adding the median value of the B.sub.0 magnetic field over the scan slice the first frequency of RF pre-pulses;
- else performing the steps of:
- ii. improving the shimming; and
 - iii. repeating steps a through e; and

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- f. obtaining an MRI image of each scan slice, wherein the MRI image of a scan slice is obtained using RF pre-pulses at the second frequency for the scan slice.
13. A computer program product for use with a computer, the computer program product comprising a computer usable medium having a computer readable program code embodied therein for acquiring an image using an MRI system, the computer program code performing the steps of:
 - a. generating a B.sub.0 map of each scan slice of the scan volume by measuring B.sub.0 magnetic field distribution over each scan slice of the scan volume and storing the B .sub.0 map in a database;
 - b. obtaining a first frequency of RF pre-pulses;
 - c. calculating median value of the B.sub.0 magnetic field over each scan slice, the calculation being done using the B.sub.0 field maps stored in the database;
 - d. calculating the percentage of positive and negative scan slice pixels in each scan slice, the calculation being done using the B.sub.0 field map for each scan slice, wherein a positive scan slice pixel is defined as a scan slice pixel with positive value in the B.sub.0 field map, and wherein a negative scan slice pixel is defined as a scan slice pixel with negative value in the B.sub.0 field map;
 - e. if the percentage of either the positive scan slice pixels or the negative scan slice pixels in each scan slice is greater than a predefined threshold value, performing the step of:

- i. calculating a second frequency of RF pre-pulses for each scan slice by correcting the first frequency of RF pre-pulses, the correction for a scan slice being done by adding the median value of the B.sub.0 magnetic field over the scan slice to the first frequency of RF pre-pulses;

else performing the steps of:

- ii. improving the shimming; and in repeating steps a through e;
- f. obtaining an MRI image of each scan slice using RF pre-pulses at second frequency for that scan slice calculated at step e;
- g. storing the MRI image of each scan slice obtained at step f in the database; and
- h. displaying the MRI images stored in the database on a display device.